

DIAGNOSES OF NEW CYPRINID FISHES OF ISOLATED WATERS IN THE GREAT BASIN OF WESTERN NORTH AMERICA

CARL L. HUBBS AND ROBERT RUSH MILLER

ABSTRACT.—One new genus, two new species, and six new subspecies are diagnosed from highly restricted endorheic basins of the western United States—*Relictus solitarius* n. gen. and n. sp., from the basins of pluvial lakes Gale, Franklin, Steptoe, and Waring; *Gila alvordensis* n. sp., from the basin of Lake Alvord; and the following new subspecies: *Gila bicolor newarkensis* and *G. b. euchila* (Lake Newark), and *G. b. isolata* (Lake Clover), *Rhinichthys oculus reliquus* (Lake Gilbert), *R. o. oligoporus* and *R. o. lethoporus* (Lake Clover).

In amplification of our general summary (Hubbs and Miller, 1948), we are now documenting in detail the correlations between the hydrographic history of the endorheic waters of the Great Basin and the differentiation of the remnant fish fauna that somehow has managed to survive in the pitiful remnants of the pluvial lakes and streams that in late Pleistocene time covered about one-fifth of the now arid area. One of the species described herein, and the post-Pleistocene desiccation of the Alvord basin to which it is rigidly confined, are under intensive study; all of the other taxa are integral parts of a major treatise now in final processing (Hubbs and Miller, in press).

The type specimens are deposited in the University of Michigan Museum of Zoology (UMMZ).

Relictus n. gen.

Type species.—*Relictus solitarius*.

A cyprinid of moderate size (larger than *Rhinichthys*), with some distinctive osteological characters: dorsal crest of maxilla greatly expanded upward and backward; cleithrum slender; supraethmoid elongate, slender medially but notably expanded laterally at front (resembling that of *Rhinichthys*); urohyal long and narrow. Vertebrae 35-39. Pharyngeal arch moderately strong and heavy, but rather thin and somewhat lacy on the strongly expanded median section; not strongly elevated at the posterior end of the tooth row; without a flattened shelf on which a second tooth row might develop; teeth 4-4 (rarely 5-4 or 4-3). Gill-rakers small and few (7-12, usually 8-11, on first arch). Mouth oblique and terminal, completely lacking horny cutting edges; no frenum or barbel. Lateral line obsolescent, rarely extending to below origin of dorsal fin, commonly disrupted; total pores 3-29. Supratemporal canal seldom complete (only 4 of 76 specimens have the commissure closed), with usually 3 or 4 (0-5) pores in each lateral segment; preoperculo-mandibular pores 11-19; mandibular pores 3-8. Scales rather small (50-70 transverse rows), poorly imbricated and markedly irregular; each usually vertically oval but sometimes becoming rectangular with age; with numerous radii on all fields (much as in *Rhinichthys* and some other Western genera). Fins small and strongly rounded; the pelvic especially and uniquely paddlelike; dorsal and pelvic both displaced backward, and both beginning at approximately the same vertical (as in the subgenus *Siphateles* of the genus *Gila* and in many species of the typical subgenus *Gila*); dorsal and pelvic rays typically 8, anal 7. Nuptial tubercles form a highly distinctive pattern on head; the largest uniserially line the infraorbital sensory canal and suborbital margin; large uniserial caducous cones (much stronger than in *Gila*) line the upper edge of the first pectoral ray; smaller cones, also strictly uniserial (not forking once as they do in *Rhinichthys*) occur along one to several following rays; in high males some tubercles develop along outer pelvic rays and along first anal rays. Head and body turgid. Coloration much as in *Siphateles*, rather even, and often with large melanophores on lower side; lacking the two lateral bands, the head stripe, the paired light spots at caudal base, and

other features characteristic of *Rhinichthys*. Intestine forming a single, simple, compressed-S loop, as in *Rhinichthys* and many other American cyprinids. Karyotype distinguished by a relatively large number (2 large and 8 small) of acrocentric chromosomes but many (12) metacentrics: remaining 28 are subtelocentric and submetacentric (total 50 as in other American cyprinids examined).

***Relictus solitarius* n. sp.**

Holotype.—UMMZ 186904, a nuptial male 60.3 mm in standard length, from upper, hillside spring on Kirkpatrick Ranch (earlier called "Atwood Ranch," later called "Don Phalan Ranch") on east side of Butte Valley north of the narrows, in east part of T.29 N., R.62 E., Elko County, Nevada, 21 km northwest of Currie; collected by the Hubbs family June 27, 1942 (collection H42-47).

The characters of the species are essentially those of the genus. Counts for the holotype and the paratypes (UMMZ 141518) from the same collection follow. Rays: dorsal 7-8 (mean 7.40), anal 6-7 (6.95), caudal 18-21 (19.17), pectoral 13-16 (14.17), pelvic 7-9 (7.95). Vertebrae: 35-37 (36.05). Scale-row counts: lateral-line 50-57 (54.6), predorsal 30-33 (31.4), dorsal to anal origins 21-23 (22.4), around body 55-58 (55.8), around peduncle 30-31 (30.2). Pores: lateral-line 13-26 (18.4), supratemporal 2-4 (3.0), mandibular 4-7 (5.33). Gill-rakers 7-11 (8.90). Measurements of holotype in thousandths of standard length: predorsal length 579, anal origin to caudal base 318, body depth 295, caudal-peduncle depth 158, head length 282, head depth 207, head width 170, snout length 76, orbit length 59, upper-jaw length 82, mandible length 102, interorbital width 88, suborbital width 41, depressed-dorsal length 223, caudal length 238, pectoral length 208, pelvic length 160.

***Gila alvordensis* n. sp.**

Holotype.—UMMZ 130495, an adult female 70.7 mm in standard length, from Trout Creek, tributary to Alvord Desert, in Harney County, Oregon; just below the canyon and just below bridge where roads to Denio, Jordan Valley, and Fields meet, in southeast part of T.39 S., R.36 E.; collected by the Hubbs family July 26, 1934 (collection M34-87).

A chub of moderate size (though usually greatly dwarfed in Borax Lake), agreeing most closely with *Siphateles* (now regarded as a subgenus of *Gila*), but with scales much reduced in size and more embedded, and with radii all around, much as in *Rhinichthys* and *Relictus*. Pharyngeal teeth uniserial, normally 5-4 (rarely 5-5, 4-5, 4-4, or 4-3), with the first tooth on a moderately elevated base. Nuptial tubercles strong on the flattened and moderately twisted pectoral fin of nuptial males; developed on the outer half (by number) of the rays, over at least two-thirds of the width of the fin, covering nearly the full length of each thickened ray; uniserial and small on the only moderately thickened outermost ray; the row branching once on each of the following rays: very strong on rays 2 and 3 (on the ridge of the distorted fin), then decreasing inward in number and size; each tubercle set on a single ray segment and rising from a large rounded base to end in a rather narrow and sharply pointed, essentially erect, tip (with only a slight cant basad); in high males similar but weaker tubercles discernible on the pelvic fin, but not on other fins; minute excrescences, simulating tubercles, over the top and sides of head in high males. General color dusky with a continuous file of large melanophores, usually uniserial or nearly so, aligned on either side of the back.

Fin rays: dorsal 7-10 (normally 7), anal 6-9 (normally 7), caudal 17-20 (normally 19), pectoral 12-17, pelvic 7-9 (normally 8). Gill-rakers: 16-22, usually short, especially forward. Measurements of holotype in thousandths of standard length: predorsal length 568, anal origin to caudal base 312, body depth 250, caudal-peduncle depth 129, head length 267, head depth 163, head width 139, snout length 77, orbit length 48, upper-jaw length 72, mandible length 100, interorbital width 85, suborbital width 33, depressed-dorsal length 204, caudal length 238, pectoral length 191, pelvic length 141, pelvic insertion to anal origin 185.

***Gila bicolor newarkensis* n. subsp.**

Holotype.—UMMZ 188893, a nuptial male 68.0 mm in standard length, from spring in

Newark Valley on west side near Diamond Peak (called South Peak in 1934), on alluvial slope about opposite south end of Newark Dry Lake, near middle of T.10 N., R.55 E., in northwestern White Pine County, Nevada; collected by the Hubbs family September 11, 1934 (collection M34-206).

A medium to rather small-sized chub (largest of many specimens 97 mm long). General color tone darker and more uniform than in *G. b. obesa*, not closely approaching the bicolored pattern of that subspecies; dark pigmentation of sides less uniform than in other forms, because of the thick and broad concentration of melanophores around margins of scale pockets, leaving the rounded central area of pockets largely clear, to form rather conspicuous stripes along the horizontal scale rows; the dark pigment extending farther down, usually more or less completely rounding caudal peduncle; basicaudal spot replaced by a thin blackish streak along curving posterior border of squamation. Head and body strongly turgid, rounded in all aspects. Muzzle broadly rounded; mouth generally low, curved, and less oblique than usual, becoming more nearly horizontal forward; mandible slightly included at tip. Nuchal region more humped than in most forms; dorsal contour scarcely elevated at front of dorsal fin. Fins distinctively rounded, without any falcation; unusually large; sexual dimorphism in fin lengths extreme. Anal-ray count averaging low, modally 7; pelvic rays averaging 8.10 and 8.66 in two races. Vertebral and scale counts averaging low (scale counts around body averaging fewer than 47; those around peduncle fewer than 27). Gill-rakers outstandingly few (modally 12), short, soft, and swollen. Pharyngeal teeth usually 5—4.

***Gila bicolor euchila* n. subsp.**

Holotype.—UMMZ 124938, an adult female 141 mm in standard length, from Fish Creek Springs in northwestern part of Fish Creek (Little Smoky) Valley, in main ditch about 0.5 km below junction of two main spring-fed branches, in Sec. 8, T.16 N., R.53 E.; near southwest corner of Eureka County, Nevada; collected by the Hubbs family August 17, 1938 (collection M38-134).

An outstandingly large chub (for an isolated population), males reaching 114 mm and females 149 mm; the distinction in bulk is even more striking than in length. Agreeing with *G. b. newarkensis* in color pattern (as described above), but differing in color: females deep moss-green on back, with scale borders tending to converge backward, with sides usually mottled or speckled on individual scales, with lower fins deep-olive, grading to blackish on rays and to yellowish on membranes, and with dorsal and caudal fins very dark olive; adult males with much more gilt than females on cheeks, opercles, and sides, and with gilt on body somewhat rosy, with blue reflections rather strong on lower sides, with scale margins ventrally orange-red, with a considerable wash of lemon-orange on dorsal and caudal fins, with axils of paired fins rather bright orange, with this color rather strong on interradial membranes, and with rays of lower fins deep-olive. Body contours typically much less turgid than in *G. b. newarkensis*, and head much more pointed in side view, with the tip much nearer horizontal midline of head; anterodorsal profile much straighter and less decurved; head much larger; suborbital and muzzle wide and flat; mouth much larger, straighter, and more oblique, with particularly massive lips and mandible (yet tip of mandible is also slightly included). Fins hardly falcate, but less rounded than in *G. b. newarkensis*. Supratemporal canal, as also only in *G. b. newarkensis*, but in contrast with other forms of *G. bicolor*, more often complete than incomplete. Dorsal fin more posteriorly inserted than in other subspecies, even more than in *G. b. newarkensis*. Paired fins in males larger than in nearly all other populations studied. Scale-row counts, as in *G. b. newarkensis*, average lower than in other forms, with little overlap in most categories. Gill-rakers average few and generally shorter and less hard than usual in *G. b. obesa*.

***Gila bicolor isolata* n. subsp.**

Holotype.—UMMZ 186906, an adult female 85.8 mm in standard length, from Warm Springs of Independence Valley (also known as Ralph's Warm Springs), just off base of Pequoop Mountains, approximately on edge of bed of pluvial Lake Clover, on either side of

T.35-36 line near middle of R.66 E., in east-central Elko County, Nevada; collected by Miller and Hubbs August 25, 1965 (collection M65-33).

A somewhat dwarfed chub (largest male 73 mm and largest female 91 mm long). Unpigmented ventral band wider than in *G. b. newarkensis* and *G. b. euchila*; the pigment almost never rounding peduncle below; however, almost all specimens have a highly distinctive black speck on midventral line at the very outset of the lower procurent caudal rays. Anterodorsal profile less rounded and decurved than usual in *G. b. newarkensis*. As in *G. b. obesa*, contrasting with *G. b. newarkensis* and *G. b. euchila* front tips of mandible and upper lip about even; in contrast with *G. b. newarkensis*, mouth nearly straight, and sufficiently oblique to rise nearly to lateral midline of head. Lateral line, even in larger adults, usually incomplete posteriorly, lacking at least on peduncle, usually throughout that region and in some farther forward, where it may be either lacking or interrupted. Supratemporal canal regularly complete, as in none of the other subspecies studied. Dorsal fin, with little overlap, farther back than in any of the other forms considered except *G. b. newarkensis* and *G. b. euchila*. Distance from anal origin to caudal base averaging shorter than in the other subspecies considered, including *G. b. newarkensis* but not *G. b. euchila*. Mandible averaging larger than in other forms considered, except *G. b. euchila* and the variant form of *G. b. obesa* in Sulphur Spring (Diamond Valley). Sexual dimorphism of pectoral fin about as in *G. b. obesa*, much less than in *G. b. newarkensis* and *G. b. euchila*. Anal rays predominantly 7 rather than 8—as also in *G. b. euchila* and two of the three populations of *G. b. newarkensis* studied. Pelvic rays predominantly 8 instead of 9 (as in two *G. b. newarkensis* populations). Numbers of vertebrae and scale rows low. Gill-rakers also few (8-14, averaging 11.14). Rakers essentially like those of *G. b. obesa*.

Rhinichthys osculus reliquus n. subsp.

Holotype.—UMMZ 124906, an adult female 67 mm in standard length, from spring-fed creek in a grassy meadow in the partly enclosed southwestern arm of Grass Valley, 13 km east of Mt. Callaghan, in course of Callaghan (Woodward) Creek, on Grass Valley Ranch, in SW 1/4, Sec. 10, T.21 N., R.46 E., in eastern Lander County, Nevada; collected by Hubbs family and Miller, August 9, 1938 (collection M38-116).

A relatively large dace, despite its occurrence (now apparently extinct) in a restricted habitat; largest size 82 mm. Quite different in appearance from *R. o. robustus*: body less speckled; blackened regenerated scales rather fewer and less emphasized; underlying main dark lateral band generally broader, more solid, more even-edged. Pattern further intensified by more definitely lightened ground color between this lateral band and the dark, broad predorsal stripe. Deep-lying giant melanophores often formed on the lower sides, especially posteriorly, much more conspicuous than in *R. o. robustus*, forming punctulations somewhat similar to those on this region in subgenus *Siphateles* of *Gila*. Lower dark lateral line, usually rather well developed in *R. o. robustus*, obsolescent. A very distinctive dark streak or wedge developed along lower border of caudal peduncle. Head characteristically darkened from the dark area of the suborbital region, and from front of mouth, upward and backward over front and top of head: horizontal dark stripe on snout, characteristic of *R. o. robustus*, barely even suggested. Vertical fins also more uniformly darkened, and less speckled, than in *R. o. robustus*, with hardly a trace of the especial blackening at the bifurcation of the rays. Lower lip, even in specimens with lower surface of head elsewhere devoid of pigment, heavily punctate all around. Red color often apparent in *Rhinichthys osculus*, in axils of paired fins, about mouth, and on preopercle, scarcely evident in life. Body more turgid in nuchal region, and snout more rounded, more declivous, and broader (overall width of mouth, in consequence, approximately equally as long as, rather than shorter than, the snout). Mouth as seen from below broadly U-shaped, instead of being narrower approaching a V. Barbel almost invariably absent. Lateral line on both body and head greatly reduced; supratemporal canal commissure consistently interrupted medially, typically very widely. Body averaging slenderer than in other forms; caudal-peduncle depth is less than in *R. o. lethoporus*, with slight overlap. Pelvic-fin insertion more posterior than in any other form considered. Sexual dimorphism in pectoral-fin length most extreme. Dorsal fin more posteriorly inserted in males than in females, on the average, con-

trary to findings for other forms of *Rhinichthys* (and for cyprinids in general). Pectoral-ray counts on the average lower than in other subspecies treated. Caudal vertebrae definitely averaging fewer. Scale counts averaging consistently higher than in the two forms described below.

***Rhinichthys oculus oligoporus* n. subsp.**

Holotype.—UMMZ 186902, an adult female 55.2 mm in standard length, from Warm Springs in Clover Valley, at Warm Creek (formerly Clover) Ranch, near southeastern corner of Clover Valley, near foot of bajada just above the ancient bed of Lake Clover, in Sec. 7, T.33 N., R.61 E., in southeastern Elko County, Nevada; collected by James E. Deacon and Mary Beth Rheuben September 14, 1964.

A dace of about average size. Body more extensively speckled with black than in *R. o. robustus*; lower lateral band as a rule much less or not at all evident; dark pigmentation around snout generally diffused, with no evidence of the usual horizontal black streak in front of eye, but retaining a tendency for its continuation across opercle. Jet-black basicaudal wedge much reduced in size and intensity, more disrupted, occasionally hardly evident. Dusky dashes on dorsal and caudal fins tending to be more numerous, but barely evident on anal fin (where often evident in *R. o. robustus*); these marks much less apt to form in, and to be largely restricted to, the crotches of the bifurcating rays. Main lateral band bordered above by a light streak, barely evident in *R. o. robustus*. Life color on back bright-olive or golden-green and below silvery, with an intervening bright-gilt stripe and with dusky mottling. Axils of paired fins and base of anal in adult male clear red (contrasting with males of *R. o. reliquus*). Differing from *R. o. robustus* in general form: outlines of body, and especially of head, more curved; head in particular more rounded, in both dorsal and lateral aspects. Mouth tending to be more definitely lower than lower border of eye, and generally more curved; whole aspect bulkier. Barbel invariably absent (51 specimens). Reduction of lateral line on body extreme (as in *R. o. reliquus* and *R. o. lethoporus*). Suborbital averaging slightly narrower than in other forms studied, *R. o. lethoporus* excepted. Pelvic-fin insertion averaging farther back than in typical *R. o. robustus* or in *R. o. lethoporus*, but farther forward than in *R. o. reliquus*. Number of rays in paired fins somewhat reduced in average number. Scale counts averaging definitely lower than in *R. o. reliquus*, about the same or not quite so low as in *R. o. lethoporus*, and somewhat lower than in more typical races of *R. o. robustus*.

***Rhinichthys oculus lethoporus* n. subsp.**

Holotype.—UMMZ 186905, an adult female 35.3 mm in standard length, from Warm Springs in Independence Valley (the same collection from which the type of *Gila bicolor isolata* was taken; see above).

Apparently the most dwarfed dace of any in the general area under consideration: the largest male measures 34 mm and the largest female 39 mm in standard length, among the 101 specimens collected (not much larger than young-of-the-year of some of the other forms). Dark speckling usually very fine, and tending to extend downward across the caudal peduncle: lower edge of peduncle often with a blackish wedge or streak. Horizontal stripe on head restricted largely to snout and upper part of opercle, usually developed, at least as a trace (much as in *R. o. robustus*, contrasting with *R. o. oligoporus*). Blackening of crotches at bifurcation of dorsal and caudal rays, and occasionally of anal rays, more as in *R. o. robustus* than in *R. o. oligoporus*. Light streak above main lateral band, frequent in *R. o. oligoporus*, obvious in only a few of the preserved specimens. Form particularly distinctive, unusually compressed for a *Rhinichthys*: greatest body width steps over the curve of the sides about 2.0 times, rather than about 1.5 times in *R. o. robustus* (*R. o. oligoporus* approximately intermediate). Anterior profile less flattened than in *R. o. robustus* and less arched than in *R. o. oligoporus*. Anterior part of head more foreshortened than in *R. o. robustus*, but rather more pointed (less rounded) than in *R. o. oligoporus*. Mouth definitely straighter than in *R. o. oligoporus*, but more oblique, rising forward to a horizontal through the lower edge of the eye. Barbel almost invariably absent, as in the two other subspecies here named. As in the other two, development of lateral line greatly reduced—even more than in *R. o. oligoporus*,

less extreme than in *R. o. reliquus*. The body proper, and more strikingly the caudal peduncle, averaging deeper than in the two other forms here described. Dorsal and anal fins are inserted farther back than in *R. o. robustus*. The mouth, strikingly, is strongly oblique and nearly straight, the upper jaw rising to about level with middle of eye. Pectoral rays average few (12.72). Vertebrae and scale rows somewhat reduced in number.

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Scripps Institution of Oceanography, La Jolla, California 92037 and The University of Michigan, Museum of Zoology, Ann Arbor, Michigan 48104.